Research Reports:

Results and Future Production and Marketing Estimates Projected from a Survey of Christmas Tree Growers in Georgia[1]

O.M. Lindstrom[2], W.J. Florkowski,[3], and D.J. Moorhead[4]
Department of Horticulture
University of Georgia
Georgia Station
Griffin, GA 30223-1797

Abstract

Virginia pine (*Pinus virginiana* Mill.) is the most planted Christmas tree in the South and its production has remained stable over the past few years. Leyland cypress [*x Cupressocyparis leylandii* (A.B. Jacks. and Dallim.) and Dallim. and A.B. Jacks.] is relatively new to the market, but the number of trees harvested has increased dramatically in the past 5 years (over 600%) where as Redcedar (*Juniperus virginiana* L.) production shows little market growth over the past 5 years. Due to the long lag period from planting to harvest, the data to correlate planting to harvests of White pine (*Pinus strobus* L.) was limited. Pearson correlation coefficients support the idea that future Christmas tree harvests can be reliably estimated from existing and estimated tree planting data for Virginia pine, White pine, Redcedar and Leyland cypress in the short term. With this information, growers can make better decisions regarding the numbers and species of trees to produce and be able to choose an appropriate marketing approach.

Index words: Christmas trees, marketing

Species used on this study: Virginia pine (*Pinus virginiana Mill.*); Redcedar (*Juniperus virginiana* L.); Leyland cypress [x *Cupressocyparis leylandii* (A.B. Jacks. and Dallim.) and Dallim. and A.B. Jacks.]; White pine (*Pinus strobus* L.)

Significance to the Nursery Industry

Growers currently have no information on the types and number of Christmas trees sold each year. This study provides a means to estimate the number of trees to be harvested from annual planting data. This analysis holds great promise to provide information on the changing composition of Christmas tree supply. With judicious use, growers can predict changes in the relative shares of different types of trees and use this opportunity to enhance profitability.

Introduction

Christmas trees have been successfully grown in the southern states for several decades. Species that are suc-

[1]Received for publication December 17, 1991; in revised form June 3, 1991. This study was supported in part by a grant from the Georgia Christmas Tree Association.

[2]Assistant Professor, Department of Horticulture.

[3]Assistant Professor, Department of Agricultural Economics.

[4]Associate Professor, Extension Forest Resources Department, The University of Georgia Cooperative Extension Service, Tifton, GA 31793.

The *Journal of Environmental Horticulture* (USPS Publication No. 698-330) is published quarterly in March, June, September, and December by the Horticultural Research Institute. Subscription rate is $45.00 per year in USA; $60.00 per year for others. Second-class postage paid at Washington, D.C. and at additional mailing office. Send address changes to HRI, 1250 I Street, N.W., Suite 500, Washington, D.C. 20005.

cessfully grown have low fertility requirements and are produced on a variety of sites throughout the southern United States (2). The warmer climate in the South extends the growing season, reducing the planting to harvest time lag of many species, as compared to the Midwest or Northeast regions.

In order for Christmas tree growers to effectively plan for future tree production and marketing, projections of the future Christmas tree availability are required. Therefore, the objective of this study is to provide estimates of the number of Christmas trees available for the Georgia market in the coming years. Using the Pearson correlation coefficient, we developed estimates of future supply of Virginia pine (*Pinus virginiana* Mill.), White pine (*Pinus strobus* L.), Redcedar (*Juniperus virginiana* L.), and Leyland cypress [x *Cupressocyparis leylandii* (A.B. Jacks. and Dallim.) and Dallim. and A.B. Jacks.] Christmas trees originating in Georgia. A prior knowledge of future Christmas tree supply offers growers an opportunity to efficiently allocate scarce resources and enhance profits.

Materials and Methods

The study used data obtained from Georgia Christmas tree growers collected through a mail survey in the spring of 1989. The sample included growers who were identified by the Cooperative Extension Service as commercial Christmas tree growers. The majority of respondents (82%) were members of the Georgia Christmas Tree Association (GCTA) while a third of surveyed growers (33%) were members of the National Christmas Tree Association (NCTA).

Out of 475 questionnaires mailed, 153 were returned and considered usable (32%). The questionnaire consisted of several categories, including questions about production practices, past and future tree plantings, harvests, and tree marketing.

To test the relationship between past and future plantings of Christmas trees and past and future harvests, the Pearson product-moment correlation coefficient was applied. The value of the Pearson correlation coefficient indicates, in this case, the closeness between past plantings or intentions to plant and the number of trees harvested or intended to harvest. The Pearson correlation coefficient is a dimensionless index with values ranging from -1 to $+1$ (8). The higher the value of the coefficient the higher the correlation between the studied events. The formula for the coefficient, developed by Pearson, is:

$$r = \Sigma(X_i - \overline{X})(Y_i - \overline{Y})/[\Sigma(X_i - \overline{X})^2\Sigma(Y_i - \overline{Y})^2]^{1/2}.$$

In the case of this study, X is the number of trees planted and Y represents the number of trees harvested or intended to harvest, and subscript i represents an individual observation.

The calculated correlation coefficient between the number of trees planted and harvested accounted for the lengths of the biological lag that occurs between planting and harvest and the fact that not all the trees planted in the same year will be harvested in the same year. The number of growing seasons necessary to produce a salable tree varies among Christmas tree varieties. For example, Virginia pine is harvested after the fourth, fifth, and sixth season of growth in the field (2). As a result, Pearson coefficients for Virginia pine were calculated between plantings in 1985 and the number of trees projected to be harvested in 1989, 1990, and 1991 to find which lag time would give the best correlation coefficient. Likewise, the optimum planting-to-harvest time lags were calculated for the remaining Christmas tree types. The time lags, which gave the highest correlations and were used in our analysis to calculate the Pearson coefficient, were five years for Virginia pine, Redcedar, and Leyland cypress and eight years for White pine. In all cases the number of lag years giving the highest correlation coefficient in our analysis agrees with the number of years from planting in which the majority of each tree type is reported to be harvested in Georgia (3, 4).

Results and Discussion

Among surveyed growers, eight percent no longer were actively producing trees. The majority of these growers discontinued production between 1987 and 1988, approximately 9–11 years after starting a plantation. Respondents listed larger than expected labor requirements (42%), difficulties in marketing (25%), and poor seedling survival (25%) as the main reasons for leaving the industry.

Pearson coefficients calculated for Virginia pine plantings and projected harvests suggest a good correlation between the number of trees planted and the number of trees estimated to be harvested five years later (Table 1). The total number of trees planted from 1985 to 1988 has gradually decreased, but growers expect to harvest a higher percentage of their trees, planted five years earlier, every year through 1993 (Table 2). Generally, about half of the Virginia pines survive from planting to market (6). Therefore, the projected increase of harvesting as a percent of planting of about 57% (1990) to 71% (1993) may be an overly optimistic estimate of the number of trees to be harvested in the future years.

Redcedar has been a traditional Christmas tree throughout the southern United States, although the survey shows that Virginia pine currently dominates the Christmas tree market. Redcedar is susceptible to diseases and is difficult to handle by growers and consumers because of its sharp needles and poor foliage retention. Growers expect to harvest considerably fewer Redcedars than Virginia pines because of the low disease resistance of Redcedar and the size of the market (Table 2). The Pearson coefficients again showed a good

Table 1. Pearson correlation coefficients calculated for the number of Christmas trees planted or intended to plant and estimated harvests.

Specie	Year planted	Year harvested	Number of lag years	Pearson coefficient
Virginia pine	1985	1990	5	.937
	1986	1991	5	.798
	1987	1992	5	.738
	1988	1993	5	.878
Redcedar	1985	1990	5	.657
	1986	1991	5	.756
	1987	1992	5	.845
	1988	1993	5	.805
Leyland cypress	1985	1990	5	.512
	1986	1991	5	.724
	1987	1992	5	.509
	1988	1993	5	.889
White pine	1985	1993	8	.751

Table 2. Estimated Christmas trees harvested as a percent of those planted five growing seasons earlier for Virginia pine, Redcedar and Leyland cypress and eight seasons earlier for White pine.

	Year planted	Number of respondents	Quantity planted	Year harvested	Quantity harvested	Harvested as percent of planted
Virginia pine	1985	58	230903	1990	132830	57.5
	1986	61	185810	1991	119750	64.4
	1987	49	170850	1992	115850	67.8
	1988	57	156050	1993	111550	71.5
Redcedar	1985	15	9950	1990	2855	28.7
	1986	15	7600	1991	3900	51.1
	1987	15	9575	1992	4975	52.0
	1988	17	9950	1993	5050	50.8
Leyland cypress	1985	5	1180	1990	975	82.6
	1986	11	1550	1991	1895	122.3
	1987	19	3771	1992	4165	110.4
	1988	25	7000	1993	6670	95.3
White pine	1985	13	10735	1993	5300	55.0

correlation between the number of Redcedar seedlings planted and the number of trees estimated to harvest five years later (Table 1). The relationship was not as strong for Virginia pine, due in part to the fewer number of data points used in the coefficient calculations. The number of seedlings planted from 1985 to 1988 remained fairly constant with the exception of 1986, while the expected number of trees to be harvested in 1990 to 1993 gradually increased. The trees harvested as a percent of seedlings planted five years earlier was consistent at around 50% except for the 1990 expected harvest.

The Pearson coefficient calculated for Leyland cypress was not as strong for Virginia pine or Redcedar from 1990 through 1992, but was fairly strong in 1993 (Table 1). The numbers of Leyland cypress seedlings planted increased dramatically from 1985 to 1988 as did the number of trees expected to be harvested five years later (Table 2). The harvested trees as a percent of seedlings planted five years earlier ranged from about 83% in 1990 to over 122% in 1991. The percent of seedlings planted that are expected to be marketed are higher in Leyland cypress than Virginia pine or Redcedar. However, the Leyland cypress estimated to be harvested as a percent of those planted five years earlier is out of line for 1991 (122%) to 1993 (110%) (Table 2). This may be due, in part, to the fact that Leyland cypress is a relatively new addition to the Christmas tree market and still absent on many Georgia Christmas tree plantations. Growers may not be familiar with the market and over optimistically estimate future harvests. Leyland cypress may substitute for Redcedar because of its physical similarities, better disease resistance, lack of sharp needles and the ease of shaping. However, the consumer acceptance of Leyland cypress as a Christmas tree has not yet been fully tested by the market.

White pine requires a longer growing period in Georgia before harvest in comparison to other tree species discussed in this study (3). Survey data allowed for calculation of only one correlation coefficient. The coefficient showed a strong relationship between trees planted in 1985 and those expected to be harvested in 1993 (Table 1). Harvested trees as a percent of those planted five years earlier (Table 2) are in the range as reported by others (6).

Respondents tend to be realistic about the number of trees they will harvest in the near future; however, as they project harvests further into the future, they expect to harvest a higher share of planted trees. Such expectations may not account for the rate of seedling survival. Growers also assume that almost all surviving trees will develop into marketable trees without defects. Such expectations are at odds with rigid specifications of wholesale contracts which require use of the newly revised USDA standards for grades (1). If a grower plans on selling trees as choose-and-cut, the percentage of unsold trees may be even higher. Customers can ascertain the tree quality and avoid purchasing an undesirable tree. Survey results indicate that 97% of the growers sold 76% or more of their trees within Georgia. Small out-of-state sales of Christmas trees imply that the future supply will be marketed primarily in Georgia. Assuming that approximately 1 million trees are sold in Georgia annually (7), the future supply of Virginia pine, Redcedar, and Leyland cypress as reported by the survey respondents represent 14%, 13% and 12% of the total number of trees to be sold in Georgia in 1990, 1991 and 1992, respectively. The supply of all four Christmas tree species discussed in this paper and reported by survey respondents is expected to amount to 13% of the total sales in 1993. Therefore, the small Christmas tree sales to other states should have a negligible effect on the supply of trees in Georgia.

Christmas tree growers participating in the survey are primarily oriented toward in-state tree marketing. An indicator of the in-state marketing orientation is respondents' membership in their state and national organizations. The percent of respondents with membership in the GCTA was considerably higher (82%) than in the NCTA (33%). The majority of surveyed growers sold their trees as choose-and-cut avoiding numerous problems with handling wholesale quantities of trees (5).

Despite sizable in-state production, the demand for Christmas trees exceeds the local supply (7). It is possible that consumers will also demand a wider variety of trees, including spruce and fir species produced in larger quantities in northern states. However, if Leyland cypress is widely accepted by consumers, growers in southern states may expand their production. Leyland cypress could become the first southern Christmas tree marketed in large numbers to other states.

The correlation data presented in this paper support the idea that future harvests can in the short term be reliably estimated from existing or projected planting data. With this information, growers can make better decisions regarding the numbers and species of trees to produce and be able to choose an appropriate marketing approach. However, future research on the production and marketing of Christmas trees in southern states must address the issue of growing practices and the effect of selection of species on tree supply. Tree pricing and competition between retail tree outlets and choose-and-cut farms in urban areas will allow us to address the issue of Christmas tree market efficiency.

Literature Cited

1. Anonymous. 1989. United States standards for grades of Christmas trees. USDA Agricultural Marketing Service. FR DOC 89- 23043. pp. 9.

2. Davis, T.S. 1976. Market acceptance of *Pinus virginiana* as a Christmas tree. Limbs and Needles 4(2):1–3.

3. Davis, T.S. 1981. Shearing, shaping and pruning Christmas trees. Limbs and Needles 15(3):6–11.

4. Lindstrom, O.M., D.J. Moorhead and G.W. Kent. 1989. Propagation and care of Leyland Cypress Christmas trees. University of Georgia Coop. Extension Service Publication MP350. pp. 7.

5. Mitcham-Butler, E.J., L.E. Hinesley, and D.M. Pharr. 1988. Effects of harvest date, storage temperature, and moisture status on postharvest needle retention of Fraser Fir. J. Environ. Hort. 6(1):1–4.

6. Moorhead, D.J. 1986. Survey of the 1986 Georgia Christmas tree producers survey. Georgia Christmas Tree Assn. Newsletter 1(4):8–9.

7. Murray, B.R., J.W. Demski, T.S. Davis and D.C. Bachtel. 1981. Christmas tree production in the state of Georgia. Amer. Christmas Tree J. 25(4):21–24.

8. Rodgers, J.L. and W.A. Nicewander. 1988. Thirteen ways to look at the correlation coefficient. The American Statistician, 42(1):59–66.

Response of Periwinkle to Composted Sewage Sludge Used as a Soil Amendment[1]

D.A. Devitt, R.L. Morris and D.C. Bowman[2]
Department of Plant Science
University of Nevada
Reno, NV 89557

Abstract

An experiment was conducted in the greenhouse to investigate the effects of composted sewage sludge as a soil amendment on growth and mineral composition of 'Bright Eyes' periwinkle (*Catharanthus roseus* (L.) G. Dn.). Three desert soils (loamy sand, sandy loam, clay) were amended with two different composted sewage sludges (city and county) at rates of 0, 7.5, 15, 30 and 60% by volume. Plants were grown in the amended soils for four months. Composted city sludge had a positive effect on size, growth rate and number of flowers per plant in all three soils. Plants grown in soils amended with the county sludge grew poorly and developed an interveinal chlorosis. Tissue analysis suggested chlorosis was due to a calcium-induced manganese deficiency. Whole plant tissue Mn declined to as low as 23 mg/kg when the calcium in the soil extract exceeded 25 meq/liter.

Index Words: *Catharanthus roseus*, desert soils, tissue analysis, manganese

Significance to the Nursery Industry

The landscape/nursery industry has a growing need for high quality organic material for use as soil amendments, particularly in the desert southwest where soils are very low in organic matter. One promising source of organic matter is composted municipal sewage sludge. Cities across the country are seeking ways to dispose of their sewage sludge, with composting being one method that is both cost effective and environmentally sound. However, the commercial success of using composted sewage sludge as a soil amendment will depend on acceptance of the practice by horticultural and agricultural industries, which will, in turn, depend on positive experimental results.

In the present experiment, composted sewage sludge had contrasting effects on the growth and quality of periwinkle cultured in three different desert soils, depending on the source of the sludge. Because of the addition of large amounts of lime to the county sludge, an apparent calcium-induced manganese deficiency developed. This suggests that sludges with high lime content may not be appropriate for use as a soil amendment, at least with periwinkle. The greatest response to the sludge amendment was observed in the sandy soil, where water holding capacity increased dramatically. Based on flower production, a 30% composted sludge application rate of a low-lime sludge would be recommended.

Introduction

Municipalities across the country are increasingly faced with the challenge of sewage sludge disposal. Adding to this challenge, government agencies are closely regulating the disposal of such waste products to reduce the risk of environmental contamination, and actively promote the beneficial reuse of waste products whenever possible. As ex-

[1]Received for publication December 26, 1990, and in revised form June 3, 1991. The authors thank Jeff Andersen and Linda Austin for their skillful assistance and the Clark County Sanitation District for their support of this research.

[2]Associate Professor, Cooperative Extension Agent, and Assistant Professor.